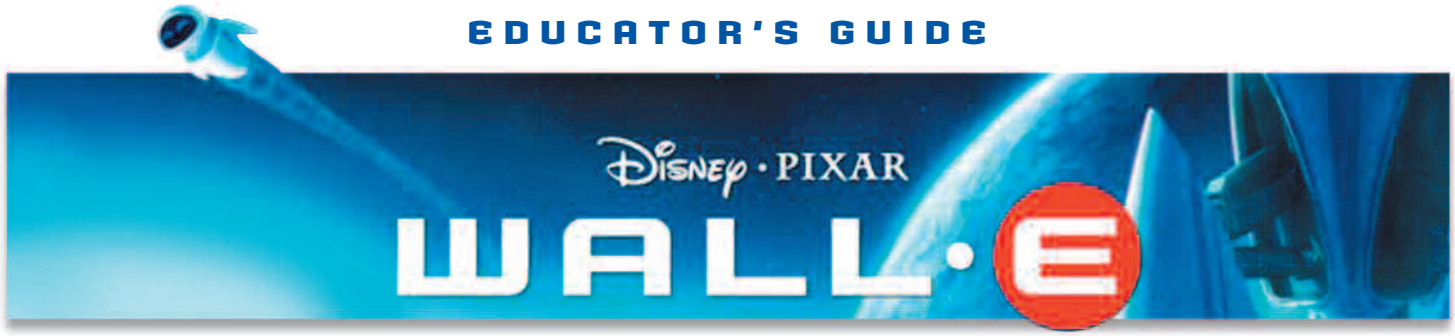

Program Synopsis

WALL• E is a computer animated film about a robot named *WALL• E* who was designed to clean the pollution that has forced humans to find temporary refuge in outer space. When *WALL• E* finds proof that Earth can once again sustain life, he unknowingly embarks on an adventure across the universe.

The activities in this Educator's Guide are based on themes from the film, such as caring for the environment, robotics, traveling in space, and earth materials. Activities allow students to explore these themes further as they apply research, writing, analytical, and teamwork skills.

Objectives and Standards

The content of the **DVD** addresses the following objectives:

Students will understand that:

- Human behavior can harm the environment.
- Photosynthesis is necessary to sustain life on Earth.
- Soil is an earth material.
- Planting and watering seeds are part of the process of growing food.
- Taking care of plants is one way to protect the environment.

The activities in this **Educator's Guide** address the following objectives:

Students will:

- Write a story about creative ways that they could reuse an object.
- Develop an idea for a robot that would help the environment today.
- Learn how composting with worms can help recycle food waste that would otherwise go to the landfill.
- Read a story about the solar system and design a poster about one aspect of the story.
- Students will research the effect of the Earth's gravity on their bodies.
- Hold a debate about the role of corporations in protecting the environment.
- Expose students to some aspects of the real-world issues in programming robots.
- Develop a poster presentation about robots and robotics.
- Work as a team to develop a creative presentation about orbital debris (space junk).
- Encourage students to observe and quantify the effect of music on the human brain.

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Academic Standards Addressed

DVD or Activity		Grade Level	Language Arts (NCTE)	Science (NSTA)	Social Studies (NCSS)	Technology (ISTE)
DVD Content		K and up	None addressed.	**C.** Life Science **D.** Earth and Space Science **F.** Science in Personal and Social Perspectives	None addressed.	None addressed.
Educator's Guide Activities	**Use It and Reuse It**	K-5	**4.** Students adjust their use of spoken, written, and visual language… **5.** Students employ a wide range of strategies as they write… **6.** Students apply knowledge of language structure…	**F.** Science in Personal and Social Perspectives	None addressed.	None addressed.
	My Robot	K-5	**1.** Students read a wide range of print and nonprint texts… **7.** Students conduct research on issues and interests… **8.** Students use a variety of technological and informational resources…	**E.** Science and Technology **F.** Science in Personal and Social Perspectives	None addressed.	**1.** Creativity and Innovation
	Act Like a Robot	K-5	None addressed.	**E.** Science and Technology **F.** Science in Personal and Social Perspectives	None addressed.	**1.** Creativity and Innovation
	Create a Compost	K-5	None addressed.	**C.** Life Science **D.** Earth and Space Science	None addressed.	None addressed.
	Magical Journey in Space	K-5	**2.** Students read a wide range of literature…	**D.** Earth and Space Science	None addressed.	None addressed.
	A Corporate Debate	6 and up	**4.** Students adjust their use of spoken, written, and visual language… **11.** Students participate as knowledgeable, reflective, creative, and critical members…	**F.** Science in Personal and Social Perspectives	VIII. Science, Technology, and Society	None addressed.
	Robots Today and Tomorrow	6 and up	**1.** Students read a wide range of print and nonprint texts… **4.** Students adjust their use of spoken, written, and visual language… **5.** Students employ a wide range of strategies as they write… **6.** Students apply knowledge of language structure… **7.** Students conduct research on issues and interests… **8.** Students use a variety of technological and informational resources…	**F.** Science in Personal and Social Perspectives	**VIII.** Science, Technology, and Society	**3.** Research and Information Fluency
	Space Junk	6 and up	**1.** Students read a wide range of print and nonprint texts… **4.** Students adjust their use of spoken, written, and visual language… **5.** Students employ a wide range of strategies as they write… **6.** Students apply knowledge of language structure… **7.** Students conduct research on issues and interests… **8.** Students use a variety of technological and informational resources…	**D.** Earth and Space Science **E.** Science and Technology **F.** Science in Personal and Social Perspectives	**III.** People, Places, and Environments **VIII.** Science, Technology, and Society	**3.** Research and Information Fluency
	How Tall Am I?	6 and up	None addressed.	**A.** Science as Inquiry **C.** Life Science **D.** Earth and Space Science	None addressed.	None addressed.
	The Science of Music and Emotion	6 and up	None addressed.	**A.** Science as Inquiry **C.** Life Science	None addressed.	None addressed.

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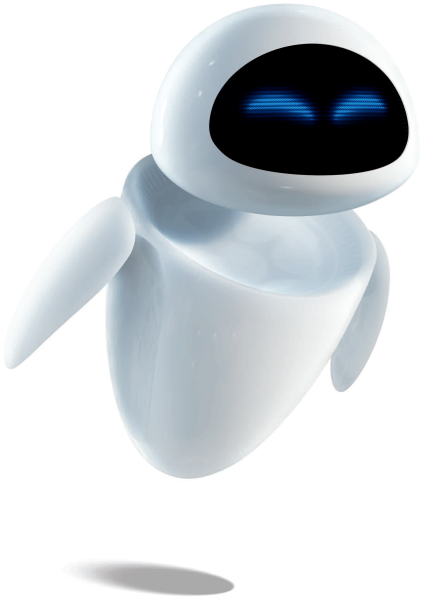
Preview Questions

1. What is a robot?
2. What is the difference between a robot and a human?
3. What do humans need to be able to exist on the Earth?
4. How do plants grow?



Postviewing Questions

1. Why are plants important to life on Earth?
2. In the film, why did it become impossible for humans to live on the Earth?
3. What do you think we should do to prevent what happened to Earth in the film?
4. If you could create a robot to do anything, what would you design it to do and why?

Suggested Classroom Activities

Grades K-5

Use It and Reuse It:
WALL-E's job is to clean up the trash that has polluted Earth. But, every now and then, he finds an item he wants to keep and reuse in a new way, such as using a cooler as a backpack or a hub cap as a hat. Reusing items helps the Earth because it reduces waste, reduces pollution, and conserves natural resources. Think about some of the things you've considered throwing away. How might you reuse them instead? Write a story about how you could reuse an object in multiple ways. Be creative, just like WALL-E!

My Robot
Ask students to come up with an idea for a robot that would help the environment today. What would it look like? What would it do? Have students draw a picture of their robot and write a description of its purpose. Then have them present their robots to the class.

Act Like A Robot
In the Eco-Robot bonus feature, one of the programmers says, "The robot's only as smart as the program we give it." Divide the class into groups of two. Have students take turns playing the role of the programmer and the robot. The programmer's role is to give instructions on a mundane but multi-step task, such as making a peanut butter and jelly sandwich or putting away books and papers into a backpack. The robot's role is to do EXACTLY what the programmer tells it to do. For instance, if the programmer tells the robot to put peanut butter on the bread, the robot might put the unopened peanut butter jar on top of the unopened loaf of bread. Hilarity and frustration, in roughly equal doses, should ensue.

Questions for discussion:
Is it difficult or easy to program a robot?
How do you know how to do a task like making a PB&J?
Why is it difficult for robots to think like humans?

Create a Compost
In the film WALL-E, we see the problems caused by generating too much waste. Explain to students that some of the waste people throw out every day is food waste, which can be "recycled" by composting. Do a class project about composting with worms. Helpful resources include the following:

Environmental Education for Kids: http://www.dnr.state.wi.us/org/caer/ce/eek/earth/recycle/compost2.htm

The Great Plant Escape: http://www.urbanext.uiuc.edu/gpe/case2/c2a2.html

Magical Journey in Space
Read aloud Joanna Cole's *The Magic School Bus Lost in the Solar System* and then have students design and present a poster about something that they learned from the story.

Grades 6 and up

A Corporate Debate:
[Links to the scene featuring Buy 'n Large as a mega-corporation.] Buy 'n Large is a fictitious mega-corporation that became the producer of every economic service on Earth, before pollution drove humans into exile in outer space. Should Buy 'n Large have had corporate responsibilities that prevented this pollution in the first place? Hold a debate about corporate responsibility regarding the environment. To what degree should corporations be held responsible for their impact on the environment?

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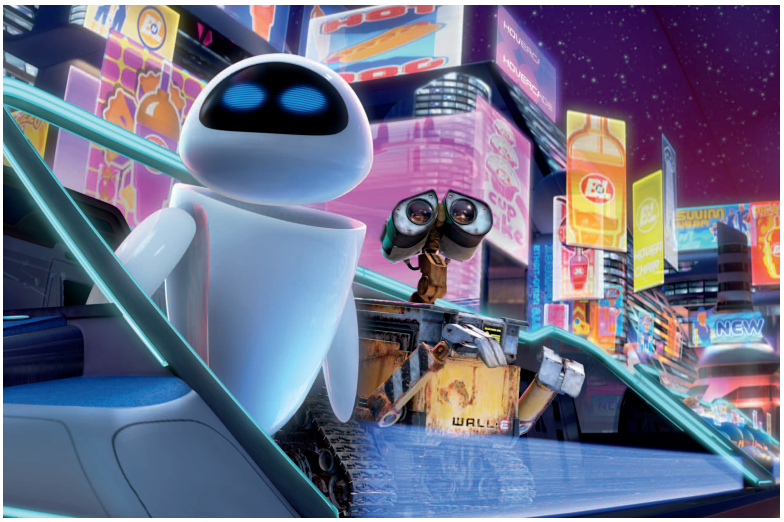
Robots Today and Tomorrow

Robots are used to do everything from vacuuming rooms to reducing the shakiness of a surgeon's hand during microsurgery. Have students do research about robots and present their findings in a poster. Ask them to answer the following questions:

- What is a robot? What types of work do robots do?
- How are robots used for exploration on the Earth and in outer space?
- How do robots move?
- What is a degree of freedom? Describe the basic degrees of freedom that a robot needs.
- What is a sensor? How do robots use light sensors?
- What are the challenges involved in robotic vision?
- How do touch sensors help robots navigate?
- Describe three approaches to robotic intelligence.
- What is a universal robot?
- What will robots of the future be able to do?
- What are Isaac Asimov's Three Laws of Robotics? In what way are they being violated today?



Helpful resources include the following:

How Stuff Works: http://science.howstuffworks.com/robot.htm

Tech Museum of Innovation: Robotics: http://www.thetech.org/robotics/universal/index.html

Space Junk

Burned-out satellites, flecks of paint from spacecraft, a wrench dropped by a spacewalking astronaut. These are a few examples of the trash that is orbiting the Earth. Scientists call it orbital debris. It's more commonly known as space junk. Have students work in teams to develop a creative presentation about space junk, using the following resources:

ABC News: http://abcnews.go.com/Technology/wireStory?id=5755235

How Space Junk Works: http://science.howstuffworks.com/space-junk.htm/printable

NASA Orbital Debris Program: http://www.orbitaldebris.jsc.nasa.gov/

National Geographic: http://science.nationalgeographic.com/science/space/solar-system/orbital.html

PBS Wired Science: http://www.pbs.org/kcet/wiredscience/story/82-who_ll_take_out_the_space_trash_.html

How Tall Am I?

Glossary

Zero gravity: A sense of weightlessness found in space.

Earth's gravity: When you are at or near sea level on Earth, the gravitational attraction exerted on an object. Gravitational force is a force of acceleration.

Weight vs. Mass: Weight is a function of gravity. In Earth's gravity, objects have both weight and mass. In zero gravity, an object has no weight, but it still has mass. Although that object is weightless, it still takes effort to move it. A way to illustrate this is to float a Popsicle stick and a log in water. Both are floating (or weightless for purposes of the demonstration), but it still takes more effort to move the log than the Popsicle stick. In the same way, even though objects are weightless in zero gravity, it takes more effort to move an object with greater mass.

In the bonus segment, *Gravity's Effect on Humans with Bill Nye the Science Guy*, Bill suggests trying to observe the effect that Earth's normal gravity has on the human body. Give students the Student Research Sheet at the end of this guide to organize their observations. Ask them to measure themselves carefully when they get up. Then, do so again at night. Collect data over several days. What conclusions can they draw? How would their results be different in zero-g?

Hint: For the most accurate results, encourage students to measure in the same place, in the same footwear, and as accurately as possible using centimeters.

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The Science of Music and Emotion
In the bonus feature "Notes on a Score", the film's creators discuss how they use music to provide meaning. Ask students to research the science behind music and its link to emotion. Have each student find an article from a science news periodical or website; summarize the article; and share it with the class.

Next, discuss how the class might do original research on this topic. One possibility is to listen to several short music clips (see the Music section below). Have students record their feelings in single adjectives, such as "happy," "energetic," "cold," "excited." Tally the results from the whole class. Discuss the findings. Where are there similarities? Where are there differences? What accounts for these similarities and differences? How would they apply this knowledge if they were making an animated film?

Variation: How could the class obtain a larger sample size? Assign every student to ask five subjects to listen to the clips. Have each student tally his or her results, interpret them and present them. Consider aggregating all the data and interpreting those results.

Music: To find music clips to play in class, try a website such as Rhapsody.com. Here are some suggestions for classical works to play that will not be overly familiar to students:

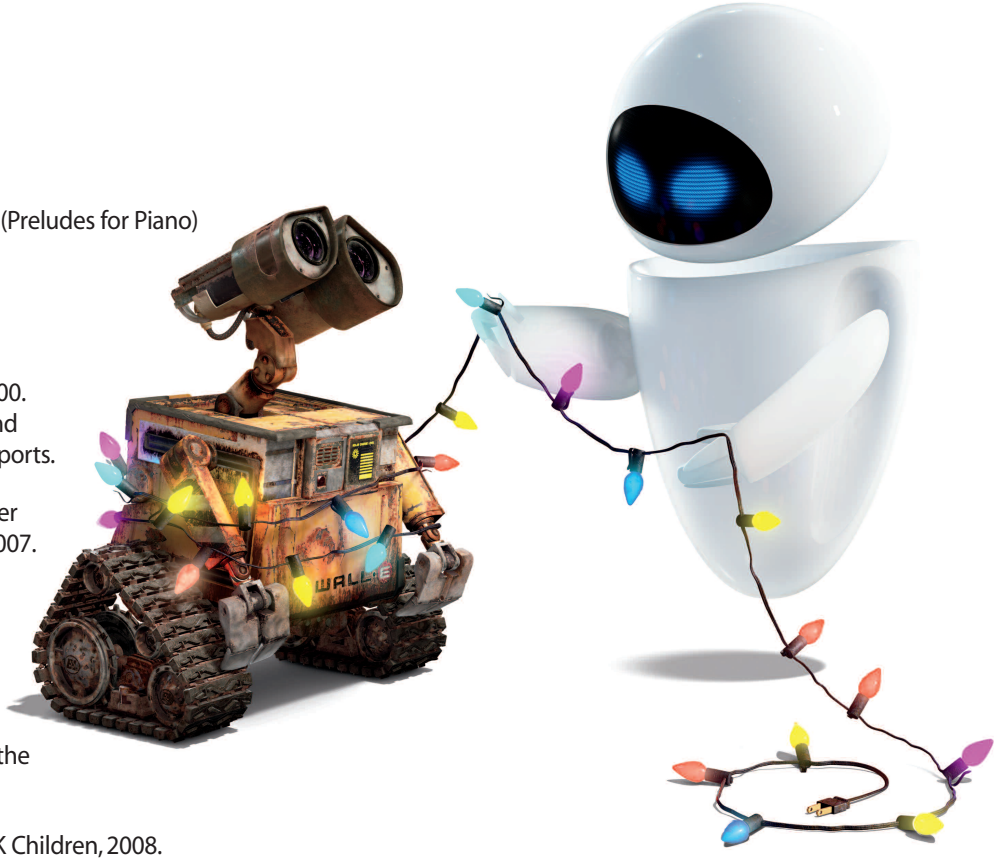
Mozart, Requiem Mass in D Minor

Vivaldi, Four Seasons, Allegro

Pachelbel, Canon in D

Pierre Boulez, Piano Sonata #1

Debussey, The Girl with the Flaxen Hair (Preludes for Piano)



Resources

Books

Bial, Raymond. **A Handful of Dirt**. Walker, 2000.
Grades 3-5. An introduction to the nature and importance of soil and the organisms it supports.

Burnie, David. **Endangered Planet** (Kingfisher Knowledge). Kingfisher/Houghton Mifflin, 2007.
Grades 4-8. An exploration of natural cycles and habitats, emphasizing the impact of humans on the environment.

Cole, Joanna. **The Magic School Bus Lost In The Solar System**. Scholastic Press, 1992.
Grades K-5. Ms. Frizzle's class takes a tour of the solar system.

DK Publishing. **First Space Encyclopedia**. DK Children, 2008.
Grades 4-8. An introduction to the universe, including information about the planets in our solar system, the Sun and other stars, black holes, asteroids, comets, and galaxies.

Dyson, Marianne J. **Space Station Science: Life in Free Fall**. Scholastic Reference, 2004.
Grades 5-8. An exploration of what it's like to live in a space station. Includes hands-on activities that simulate life in space.

Kortenkamp, David. **Space Junk (First Facts)**. Capstone Press, 2008.
Grades K-4. An exploration of the debris orbiting Earth.

DVD

Bill Nye the Science Guy: Outer Space. Prod. KCTS Seattle. DVD. Disney Educational Productions, 2003.
Grade 5 and up. This episode covers planets, stars, galaxies, and the universe.

Roving Mars. Prod. Kennedy-Marshall/White Mountain. DVD. Walt Disney Pictures, 2006.
Grade 5 and up. This documentary follows the journey of NASA's Mars Exploration Rovers through the eyes of scientists and engineers.

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Internet

ABC News: Hubble Crew Faces Higher Risk of Debris Hit
http://abcnews.go.com/Technology/wireStory?id=5755235

Carnegie Mellon University Robotics Academy
http://www.education.rec.ri.cmu.edu/
Includes resources for educators about robotics and a free curriculum for middle and high school.

Environmental Education for Kids
http://www.dnr.state.wi.us/org/caer/ce/eek/index.htm
This electronic magazine for kids in Grades 4 to 8 provides information about the environment.

How Stuff Works: How Robots Work
http://science.howstuffworks.com/robot.htm
An overview of robotics.

How Stuff Works: How Space Junks Works
http://science.howstuffworks.com/space-junk.htm/printable

KidsHealth: The Big Story on Bones
http://www.kidshealth.org/kid/body/bones_noSW.html
Describes what bones are made of and how bones grow; gives information about the spine, ribs, skull, hands, legs, and joints, as well as tips about taking care of bones. Includes a full diagram (requires Macromedia Flash).

NASA: Microgravity Educator Guide
http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Microgravity_Teachers_Guide.html
Includes microgravity-related information and activities for students in grades 5-12.

NASA: Moon Munchies Educator Guide
http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Moon_Munchies.html

NASA: Solar System Exploration
http://solarsystem.nasa.gov/index.cfm
Includes links to information about the planets and the history of robotic exploration of space, as well as a section developed just for kids.

NASA: Space Food and Nutrition Educator Guide
http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Space_Food_and_Nutrition_Educator_Guide.html

NASA Orbital Debris Program
http://www.orbitaldebris.jsc.nasa.gov/

National Geographic: Orbital Objects
http://science.nationalgeographic.com/science/space/solar-system/orbital.html

PBS Wired Science: Who'll Take Out the Space Trash
http://www.pbs.org/kcet/wiredscience/story/82-who_ll_take_out_the_space_trash_.html

The Tech Museum of Innovation: Robotics
http://www.thetech.org/robotics/index.html
Developed by the Carnegie Science Center in Pittsburgh, PA, this web exhibit includes 30 hands-on activities that introduce the world of intelligent machines: how they work, who builds them, and what they do.

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Student Research Sheet

Research Question:

Procedure:

Materials:

Observations:

Results:

Conclusions: